LLNL **Lessons Learned** LLNL

LL-2005-LLNL-14 May 18, 2005

Human Factors Play a Role in Recent Incident

One afternoon in November 2004, a Lawrence Livermore National Lab (LLNL) scientist was trying to dislodge a Class 1 sealed radioactive source from its metal assembly. Even though the scientist used (in sequence) hand impacts, a rubber hammer, and tape, the attempts were unsuccessful. The scientist then brought the source to a mechanical technician and requested assistance. Although it was late in the day and the technician was preparing to leave, the technician was anxious to satisfy the customer and agreed to help.

The technician first tried to get the source out of the assembly by using a dead-blow hammer, which failed. The technician then heated the back of the assembly with a torch in an attempt to use differential thermal expansion to free the source, which was thought to be a solid piece of aluminum. After approximately 15 seconds, the technician turned the assembly over and observed powder on the worktable on which the assembly had been placed. Recognizing the likely radioactive contamination issue, the workers responded properly by immediately contacting the Environment, Safety, and Health Team to control the scene. Fortunately, there was no personnel contamination as a result of this event.

Investigators determined that the scientist and the technician did not adequately define the scope of work and analyze the potential hazards before starting the job. Human factors can take many different forms and are often subtle enough to go unnoticed as dedicated workers focus on solving a problem or meeting a scientific or technical deliverable. LLNL prides itself on hiring the best problem solvers, those who can get the job done, working collaboratively with a wide range of experts and highly trained personnel. In this environment it is very easy for human factors, such as time pressures, and overconfidence in knowledge or assumptions, to influence our decision making and may unknowingly lead workers down the path of doing what seems safe without proper regard for following the principles and requirements of Integrated Safety Management (ISM).

In this event, the following human factors influenced the decision making of the workers:

- The work was requested at the end of a shift, causing time pressures and contributing to a mind-set to solve the challenge quickly and "on-the-spot."
- Because the source was categorized as Class I, the scientist and the technician began the work with the assumption that the source was inherently "safe." Thus, the work began without considering the ISM principles and functions, and the fact that radioactive work was not allowed in the area.
- Inaccurate assumptions about each other's knowledge level and expertise contributed to a belief that the work was safe to perform. The scientist, knowing that the technician was highly experienced, was not comfortable questioning the technician's methods. Likewise, the technician viewed the scientist as an expert on the source and trusted the scientist's knowledge and judgment.

Desire to satisfy the customer and solve a technical challenge, time pressure, and mutual overconfidence in each other's skills, knowledge, and ability were human factors that contributed to this incident. Specifically, the workers failed to recognize that their problem solving efforts, which "seemed safe," had moved the activity beyond the authorized scope of work described in the safety documentation. The workers should have stopped and sought input from supervisors or the ES&H Team when it became apparent that additional measures were needed (such as banging on the holder with a hammer). All of these factors clouded the workers judgment and their ability to recognize that they were not following the ISM principles and functions.

Analysis

- The scientist brought the stuck source to a mechanical technician late in the day. Time pressures at the end of the shift to solve a problem and satisfy the customer led to poor decision making.
- Both workers had a false sense of security because they were handling a Class I sealed source, and the hazards were considered to be insignificant.
- The workers knew that radiological work was not allowed in the shop, but their perception of the insignificant hazards associated with the source led the workers to continue without following ISM principles and functions because the work *seemed safe*.
- The worker's mutual respect for each other's expertise resulted in each worker believing that the other had enough knowledge to safely complete the task.
- The problem-solving efforts of both workers increased in a graded manner and blurred the lines of the authorized scope of work as defined by the IWS. There was no review of the hazards associated with the new task, and the controls were inadequate for the activity.

Recommended Action for LLNL Employees

1. Utilize the ISM process. Even though an activity may "seem safe," review a new task to identify if activities go beyond the scope of work authorized by the safety documentation, and thus require additional controls and authorization.
2. Stop and seek input from supervisors or your Safety Team when additional or unusual measures are needed to complete an activity.
3. Consider the influence that human factors can have on your decision-making.
    - Am I cutting corners by rushing to meet a deadline?
    - Am I taking hazards/controls for granted because I've done this many times before?
    - Is my desire to succeed technically compromising sound ES&H judgment?
4. Take two seconds before starting a task to consider what human factors may influence decisions.
5. Take two minutes to verify that current activities have not crept beyond the scope of work authorized by safety procedures.
6. Do not rely on limited information or make assumptions regarding the composition of hazardous materials in equipment or assemblies.
7. Ascertain the type of material or alloy the assembly is composed of, and determine if a danger of releasing hazardous materials exists. Review documentation, if available. Further information can be obtained by reading product specifications, or by calling the manufacturer.
8. Do not perform work that has not been authorized.
9. When supervising others, emphasize the importance of recognizing the influence of human factors in decision-making, particularly when undertaking activities that are beyond the norm.